

# PATENT ABSTRACTS OF JAPAN

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(21)Application number : **03-334901** (71)Applicant : **CASIO COMPUT CO LTD**

(22)Date of filing : **18.12.1991** (72)Inventor : **YAMAGUCHI MICHIIYA**

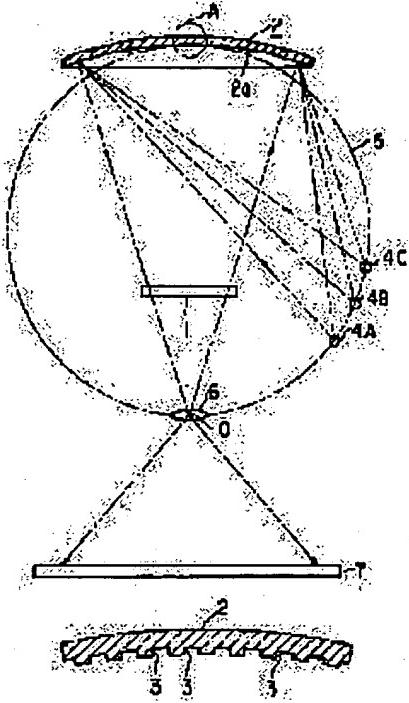
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## (54) LIQUID CRYSTAL DISPLAY DEVICE

### (57)Abstract:

**PURPOSE:** To enable a single liquid crystal display panel to display a color image without use of any color filter or dichroic mirror.

**CONSTITUTION:** On the back of a liquid crystal display panel, a photo reflex body 2 is installed which reflects white light from light sources 4A, 4B, 4C to the panel 1, and a plurality of diffractive lattice grooves 3 are formed at the concavely curved reflecting surface 2a of the photo-reflex body 2, wherein the light sources 4A, 4B, 4C are put on and off under control in the predetermined sequence and, at the same time, the driving of the panel 1 is controlled in synchronization with putting-on/off of the light sources.



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## LEGAL STATUS

[Date of request for examination]

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[Patent number]

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The light reflex object which has the reflector which curved to the concave, and the liquid crystal display panel which the tooth back was made to counter the reflector of this light reflex object, and has been arranged, The 1st thru/or the 3rd light source which irradiates the illumination light by whenever [ predetermined incident angle ] in the reflector of said light reflex object, respectively, The liquid crystal display characterized by providing two or more concave grating slots formed in the reflector of said light reflex object, and the control means which carries out drive control of said liquid crystal display panel synchronizing with lighting actuation of said light source while carrying out lighting control of said light source in the sequence which was able to be defined beforehand.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

[0001]

[Industrial Application] This invention relates to the liquid crystal display which displays a color picture.

[0002]

[Description of the Prior Art] Conventionally, this kind of liquid crystal display arranges a color filter at the tooth back of for example, a liquid crystal display panel, and it is constituted so that a color filter may color the illumination light (white light) from the light source red, blue, and green three primary colors and a color picture may be displayed. However, if shown in such a liquid crystal display, since the color filter might decolorize by the ultraviolet rays from the light source, it was weak with heat, and since one picture element was moreover formed by three pixels, there was also a problem that resolution became coarse. then, instead of using a color filter recently -- spectra, such as a dichroic mirror, -- the liquid crystal display using a means is developed.

[0003]

[Problem(s) to be Solved by the Invention] However, if shown in such a liquid crystal display The spectrum of the illumination light from the light source is carried out to red, blue, and a green three-primary-colors light with two or more dichroic mirrors. Incidence of the red and blue by which the spectrum was carried out, and the green three-primary-colors light was carried out to red, blue, and three liquid crystal display panels that corresponded green, and since it was necessary to compound the red who penetrated these liquid crystal display panels, blue, and a green image light in one image light, the whole equipment was enlarged, and there was a problem that cost moreover became high.

[0004] This invention was not made in view of the above points, and the purpose tends to offer the liquid crystal display which can display a color picture by one liquid crystal display panel, without using a color filter, a dichroic mirror, etc.

[0005]

[Means for Solving the Problem] The light reflex object which has the reflector where this invention curved to the concave in order to solve the above-mentioned technical problem, The liquid crystal display panel which the tooth back was made to counter the reflector of this light reflex object, and has been arranged, The 1st thru/or the 3rd light source which irradiates the white light by whenever [ predetermined incident angle ] in the reflector of said light reflex object, respectively, Two or more concave grating slots formed in the reflector of said light reflex object and the control means which carries out drive control of said liquid crystal display panel synchronizing with lighting actuation of said light source while carrying out lighting control of said light source in the sequence which was able to be defined beforehand are provided.

[0006]

[Function] Since according to the configuration of this invention blue, green, and a red three-primary-colors light will carry out incidence to a liquid crystal display panel one by one when sequential lighting of the 1st thru/or the 3rd light source is carried out, it becomes possible by driving a liquid crystal

display panel synchronizing with lighting actuation of the light source to express a color picture as one liquid crystal display panel, without using a color filter, a dichroic mirror, etc.

[0007]

[Example] The outline configuration of the liquid crystal display concerning one example of this invention is shown in drawing 1. In this drawing, 1 is a liquid crystal display panel, and the light reflex object 2 makes reflector 2a counter the liquid crystal display panel 1, and is arranged at the tooth-back side of this liquid crystal display panel 1.

[0008] The above-mentioned light reflex object 2 turns the illumination light (white light) from the light sources 4A, 4B, and 4C to the liquid crystal display panel 1, and reflects, and as shown in drawing 2, many concave grating slots 3 of each other are formed in reflector 2a of the shape of the spherical surface which curved to the concave of this light reflex object 2 at equal intervals in parallel. By the concave grating slot 3, these concave grating slots 3 serve as blue, green, and a red three-primary-colors light, and carry out incidence of each illumination light which it is for forming a concave grating in reflector 2a of the light reflex object 2, and was irradiated by reflector 2a of the light reflex object 2 from the light sources 4A, 4B, and 4C to the liquid crystal display panel 1.

[0009] Here, light source 4A is arranged for example, on the rowland circle 5 which is distant from the center of curvature O of reflector 2a which is the focus of a concave grating about 1.4cm, if the radius of the rowland circle 5 which is the focal curve of the concave grating formed in reflector 2a of a reflector 2 is set to 100cm. Moreover, light source 4B is arranged on the rowland circle 5 which is distant from the center of curvature O of reflector 2a about 1.7cm, and light source 4C is arranged on the rowland circle 5 which is distant from the center of curvature O of reflector 2a about 2.3cm.

[0010] Thus, if the light sources 4A, 4B, and 4C are arranged in the predetermined location on a rowland circle 5, respectively Since the diffraction angle of the illumination light irradiated by reflector 2a becomes 2.6 degrees, 3.0 degrees, and 4.2 degrees from the light sources 4A, 4B, and 4C, respectively when the pitch of the slot 3 formed in reflector 2a is set to 0.5 micrometers Incidence of blue, green, and the red three-primary-colors light can be carried out to the liquid crystal display panel 1 by the difference of whenever [ incident angle ].

[0011] In addition, incidence of the blue which carried out incidence to the liquid crystal display panel 1, green, and the red three-primary-colors light is carried out to the projection lens 6 which penetrated the liquid crystal display panel 1 and has been arranged at the condensing point (center of curvature of reflector 2a) of the light reflex object 2, and they are projected on a screen 7 through this projection lens 6.

[0012] Moreover, the light sources 4A, 4B, and 4C are turned on in the sequence beforehand defined by the light source driving signals LS1, LS2, and LS3 from the timing control circuit 9 shown in drawing 3. While making this timing control circuit 9 turn on in the sequence that the light sources 4A, 4B, and 4C were able to be beforehand defined based on the horizontal and Vertical Synchronizing signal from a synchronizing separator circuit 8, on the liquid crystal display panel 1 Blue, They are green and the thing on which a red image is displayed synchronizing with lighting actuation of the light sources 4A, 4B, and 4C. From this timing control circuit 9, besides the light source driving signals LS1, LS2, and LS3 mentioned above The segment driver driving signal SS which drives the segment driver 22 of the liquid crystal display panel 1 The timing control signal TS to which the picture signals B, G, and R of blue, green, and red are made to output synchronizing with lighting actuation of the light sources 4A, 4B, and 4C from the common driver driving signal CS which drives the common driver 23 of the liquid crystal display panel 1, and the chroma circuit 10 is outputted.

[0013] In addition, the picture signals B, G, and R which the picture signals B, G, and R of blue, green, and red were outputted as image data for one screen from the chroma circuit 10, respectively, and were outputted from the chroma circuit 10 are inputted into the segment driver 22 of the liquid crystal display panel 1 through A/D converter 11. Moreover, the liquid crystal display panel 1 consists of common drivers 23 which drive the common electrode of the body 21 of a panel, and the segment driver 22 which drives the segment electrode of this body 21 of a panel and the body 21 of a panel.

[0014] In the liquid crystal display constituted as mentioned above, as shown in drawing 4, when

sequential lighting of the light sources 4A, 4B, and 4C is carried out, blue, green, and a red three-primary-colors light will carry out incidence to the liquid crystal display panel 1 one by one. Therefore, a color picture can be expressed as one liquid crystal display panel by displaying the image corresponding to blue, green, and red on the liquid crystal display panel 1 synchronizing with lighting actuation of the light sources 4A, 4B, and 4C, without using a color filter and a dichroic mirror.

[0015] In addition, this invention is not limited to one example mentioned above, and can carry out deformation various in the range which does not deviate from the summary of this invention. For example, you may make it the above 1st thru/or the 3rd light source 4A, 4B, and 4C make the 1st location, the 2nd location, and the 3rd location carry out sequential migration of the single light source.

[0016]

[Effect of the Invention] The light reflex object which has the reflector where this invention curved to the concave as explained above, The liquid crystal display panel which the tooth back was made to counter the reflector of this light reflex object, and has been arranged, The 1st thru/or the 3rd light source which irradiates the white light by whenever [ predetermined incident angle ] in the reflector of said light reflex object, respectively, Two or more concave grating slots formed in the reflector of said light reflex object and a means to display red, blue, and a green image on said liquid crystal display panel synchronizing with lighting actuation of said light source while making said light source turn on in the sequence which was able to be defined beforehand are provided. Therefore, since blue, green, and a red three-primary-colors light will carry out incidence to a liquid crystal display panel one by one when sequential lighting of the 1st thru/or the 3rd light source is carried out, the liquid crystal display which can display a color picture by one liquid crystal display panel, without using a color filter, a dichroic mirror, etc. can be offered by driving a liquid crystal display panel synchronizing with lighting actuation of the light source.

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**TECHNICAL FIELD**

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[Industrial Application] This invention relates to the liquid crystal display which displays a color picture.

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**PRIOR ART**

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[Description of the Prior Art] Conventionally, this kind of liquid crystal display arranges a color filter at the tooth back of for example, a liquid crystal display panel, and it is constituted so that a color filter may color the illumination light (white light) from the light source red, blue, and green three primary colors and a color picture may be displayed. However, if shown in such a liquid crystal display, since the color filter might decolorize by the ultraviolet rays from the light source, it was weak with heat, and since one picture element was moreover formed by three pixels, there was also a problem that resolution became coarse. then, instead of using a color filter recently -- spectra, such as a dichroic mirror, -- the liquid crystal display using a means is developed.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] The light reflex object which has the reflector where this invention curved to the concave as explained above, The liquid crystal display panel which the tooth back was made to counter the reflector of this light reflex object, and has been arranged, The 1st thru/or the 3rd light source which irradiates the white light by whenever [ predetermined incident angle ] in the reflector of said light reflex object, respectively, Two or more concave grating slots formed in the reflector of said light reflex object and a means to display red, blue, and a green image on said liquid crystal display panel synchronizing with lighting actuation of said light source while making said light source turn on in the sequence which was able to be defined beforehand are provided. Therefore, since blue, green, and a red three-primary-colors light will carry out incidence to a liquid crystal display panel one by one when sequential lighting of the 1st thru/or the 3rd light source is carried out, the liquid crystal display which can display a color picture by one liquid crystal display panel, without using a color filter, a dichroic mirror, etc. can be offered by driving a liquid crystal display panel synchronizing with lighting actuation of the light source.

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**TECHNICAL PROBLEM**

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**MEANS**

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[Means for Solving the Problem] The light reflex object which has the reflector where this invention curved to the concave in order to solve the above-mentioned technical problem, The liquid crystal display panel which the tooth back was made to counter the reflector of this light reflex object, and has been arranged, The 1st thru/or the 3rd light source which irradiates the white light by whenever [ predetermined incident angle ] in the reflector of said light reflex object, respectively, Two or more concave grating slots formed in the reflector of said light reflex object and the control means which carries out drive control of said liquid crystal display panel synchronizing with lighting actuation of said light source while carrying out lighting control of said light source in the sequence which was able to be defined beforehand are provided.

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**EXAMPLE**

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[0009] Here, light source 4A is arranged for example, on the rowland circle 5 which is distant from the center of curvature O of reflector 2a which is the focus of a concave grating about 1.4cm, if the radius of the rowland circle 5 which is the focal curve of the concave grating formed in reflector 2a of a reflector 2 is set to 100cm. Moreover, light source 4B is arranged on the rowland circle 5 which is distant from the center of curvature O of reflector 2a about 1.7cm, and light source 4C is arranged on the rowland circle 5 which is distant from the center of curvature O of reflector 2a about 2.3cm.

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[0011] In addition, incidence of the blue which carried out incidence to the liquid crystal display panel 1, green, and the red three-primary-colors light is carried out to the projection lens 6 which penetrated the liquid crystal display panel 1 and has been arranged at the condensing point (center of curvature of reflector 2a) of the light reflex object 2, and they are projected on a screen 7 through this projection lens 6.

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[0014] In the liquid crystal display constituted as mentioned above, as shown in drawing 4, when sequential lighting of the light sources 4A, 4B, and 4C is carried out, blue, green, and a red three-primary-colors light will carry out incidence to the liquid crystal display panel 1 one by one. Therefore, a color picture can be expressed as one liquid crystal display panel by displaying the image corresponding to blue, green, and red on the liquid crystal display panel 1 synchronizing with lighting actuation of the light sources 4A, 4B, and 4C, without using a color filter and a dichroic mirror.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The outline block diagram of the liquid crystal display concerning one example of this invention.

[Drawing 2] Detail drawing of the A section shown in drawing 1.

[Drawing 3] The control-block Fig. of the liquid crystal display concerning this example.

[Drawing 4] Drawing 4 is the operation explanatory view of the liquid crystal display shown in drawing 1.

[Description of Notations]

1 [ -- A concave grating slot, 4A, 4B, 4C / -- The light source, 6 / -- A projection lens, 8 / -- A synchronizing separator circuit, 9 / -- A timing control circuit, 10 / -- A chroma circuit, 11 / -- An A/D converter, 21 / -- The body of a panel, 22 / -- A segment driver, 23 / -- Common driver. ] -- A liquid crystal display panel, 2 -- A light reflex object, 2a -- A reflector, 3

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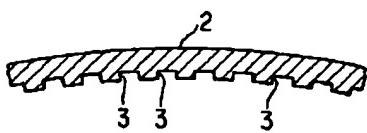
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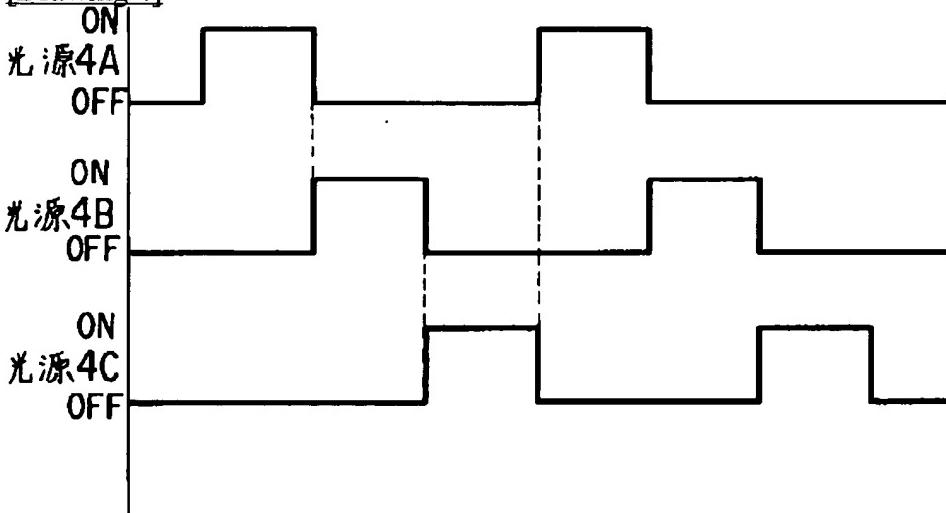
**DRAWINGS**

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[Drawing 2]

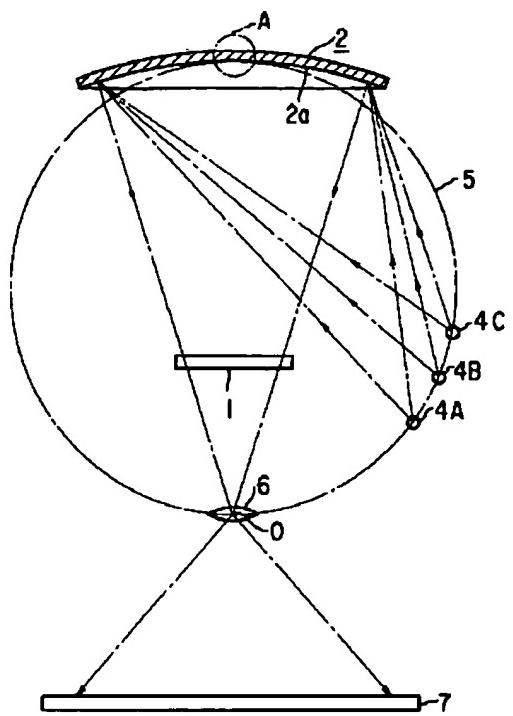


[Drawing 4]

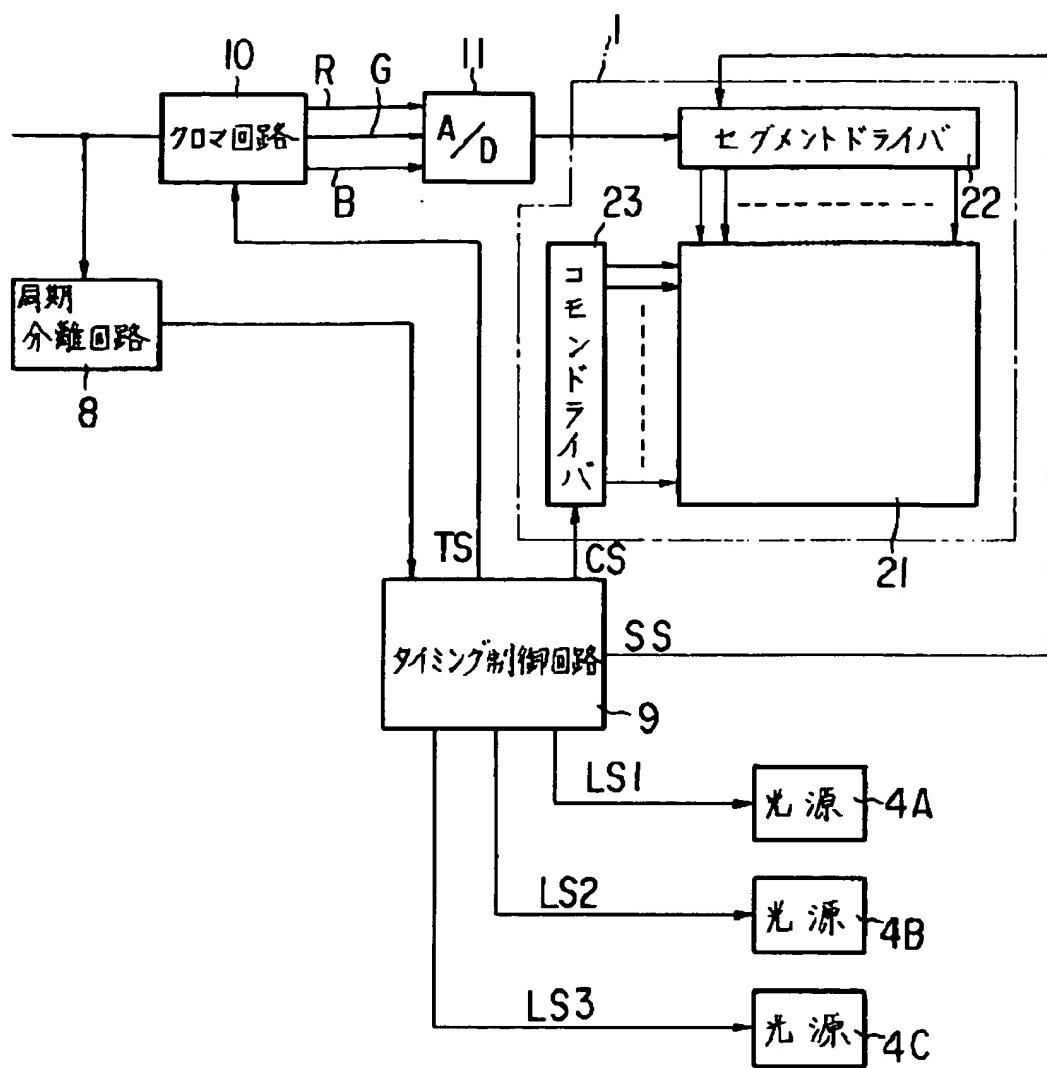


[Drawing 1]

1: 液晶表示パネル  
2: 光反射体  
4A~4C: 光源



[Drawing 3]



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[Translation done.]